

these fingerlings can be housed for better survival. They can be released later in the beel.

(2) Income can be further enhanced by organizing better marketing facilities and transportation at the site. The present selling rate of the fish is too little as compared with the rates in the neighbouring areas.

CENTRAL INLAND FISHERIES
RESEARCH CENTRE,
614, NATUN SARANIA,
GAUHATI-781 003 (ASSAM),
July 29, 1985.

ACKNOWLEDGEMENTS

We are highly indebted to Dr. A. V. Natarajan, Director, Central Inland Fisheries Research Institute, Barrackpore, for his keen interest in the project and constant guidance, and to Dr. A. G. Jhingran, Head of Division (R&L), for critically going through the manuscript.

Y. S. YADAVA
M. CHOUDHURY

REFERENCES

WISHARD, S. K. (1976): Roak fishing and its probable effect on the capture fishery of river Yamuna in Agra district. *Indian J. Fish.* Vol. 23, Nos. 1 & 2: 213-231.

YADAVA, Y. S., CHOUDHURY, M. & KOLEKAR, V. (1981): Report on the 'Katal' fishing, a special device for catching fish in beels of Assam. *Jour. Inl. Fish. Soc. India* Vol. 13, No. 1: 81-86.

24. A DRY SEASON AGGREGATION OF DANAINAE BUTTERFLIES IN CORBETT NATIONAL PARK (LEPIDOPTERA): NYMPHALIDAE: DANAINAE)

In the beginning of June, 1985 I came across a large aggregation of four species of Danaine butterflies in Corbett National Park, U.P., 600 m, India. There are several records of large aggregations of Danaine butterflies in the literature (see Ackery & Vane-Wright 1984 for an excellent review of all aspects of these interesting butterflies). Two purposes may be involved. First, the aggregation may be at a source for pyrrolizidine alkaloids, compounds that are necessary for sexual success of the males, through the activation of pheromones necessary for courtship. Such assemblies are almost wholly male. At a patch of *Ageratum conyzoides* (Compositae) in the Hauz Khas Rose Garden of South Delhi I did a random sample along a watering canal densely

bordered by this plant. Among 123 specimens collected at random only two were females, despite the fact that the plant should be an excellent nectar source. Second, the aggregations may be roosts where adult butterflies pass winters, dry seasons, or other climatic vagaries when breeding is impossible. According to Ackery & Vane-Wright (1984) such aggregations are 'well known' but poorly documented. Many variables are involved including temperature, humidity, wind conditions, nectar and water resources, and the availability of roosting sites at night'. In such aggregations both sexes will be present.

The site, near the lovely Gairal Forest Rest House, was in dense Sal forest (*Shorea robusta*) with a minimal understory vegeta-

MISCELLANEOUS NOTES

tion. The main characteristic of the site — at a very dry time of the year — was a permanent water seepage covering an area of 50 by 100 square metres. In addition there were many bare bushes which provided roosting places for the butterflies at night. Both sexes of the species in question came avidly to drink from the seepages in the forest floor. Two species of Oakblue butterflies (genus *Arhopala*) also came to drink in numbers, but otherwise butterflies were almost absent.

I did a number of transect walks through the site, catching at random any specimen within reach. Towards the end of the sampling, the three rarer species were sampled purposely, to get a better grip on their sex ratio. A full population estimate, in a population ideal for mark-recapture studies, was not possible for reasons of time. However, it may be estimated that the sampling included less than one in twenty or thirty of the actual population. This conservative estimate is used in Table 1 below, suitably adjusted for the purposive sampling of the three rarer species.

It will be seen from the table that sex ratio is quite normal, and that four fifths of all specimens referred to *Euploea core*, a species which

is known to have winter roosts in Queensland.

Danaines are butterflies with strong and persistent sexual display. Males of *Euploea core*, especially, are often seen patrolling a limited space with the pheromone dispensing abdominal hair pencils extended, even when no females are present. In Delhi I have observed one male displaying uninterruptedly for more than fifteen minutes, flying above a patch of ground less than 100 square metres. Danaines also pair readily and stay in copula for long. No example of sexual display or sexual interaction was seen during four hours of observation over two days.

The abdomens of most specimens were strongly distended, especially in the females. Dissection of two females, however, showed no trace of eggs, but plentiful reserves of fatty tissues. The specimens appeared to be in a state of sexual diapause.

There can be little doubt as to what was involved. The aggregation was a dry season roost of specimens surviving the extreme dry season and/or the extreme hot season in a state of sexual diapause. In the Corbett the dry and hot season fall at the same time, and is preceded by a winter, when breeding oppor-

TABLE 1

COMPOSITION, SEX RATIO AND STRUCTURE OF THE DANAINÉ BUTTERFLY AGGREGATION SAMPLED AT CORBETT NATIONAL PARK

Species	Male	Female	Total	Population estimate*	Per cent of population
<i>Euploea core</i> Cramer	28	28	56	1120-1620	81
<i>Danaus genutia</i> Cramer	6	7	13	200-300	15
<i>Danaus chrysippus</i> L.	2	—	2	20-30	1
<i>Tirumala limniace</i> Cramer	2	2	4	40-60	3
Total	38	37	75	1380-2010	100

* These figures match the general visual image but is lower than an alternative estimate based on population density. My guess was that one butterfly was present per square metre in the area totalling 5000 m², or slightly less.

tunities may be sub-optimal. I suspect the larvae of the species in question cannot survive in June when temperatures in the shade regularly exceeds 40° Centigrade. The site determinants are obviously the simultaneous presence of shade and water, as well as perhaps nectar sources. Very few Danaines were seen in other parts of the park, except in conjunction with similar, but smaller, water seepages. Doubtless the population of such a site builds up gradually though the recruitment of passing butterflies and with very little loss of the existing stock. It would be extremely inte-

resting if a resident of the National Park could monitor the build up and variation of such a roost during the period of an entire year. Probably the roost will dissolve with the onset of the monsoon in late June.

Towards nightfall the butterflies perch on naked twigs of understory bushes, usually about a metre above the ground. They invariably settle in little clusters of two to six specimens, a trait well known in the subfamily, probably related to the fact that the species are aposematic.

C/o. DANIDA,
7 GOLF LINKS,
NEW DELHI 110 003,
July 4, 1985.

TORBEN B. LARSEN¹

REFERENCE

ACKERY, P. & VANE-WRIGHT, R. (1984): Milkweed Butterflies. British Museum (Natural History), London.

¹ Present address: 29C Snoghoj alle, DK 2770, Kastrup, Denmark.

25. *AGERATUM CONYZOIDES* (COMPOSITAE) INDIRECTLY
CONFIRMED AS A SOURCE FOR PYRROLIZIDINE
ALKALOIDS

In their excellent review of Danaine butterflies, Ackery & Vane-Wright (1984: Table 2) include the pan-tropical weed *Ageratum conyzoides* as a probable source of pyrrolizidine alkaloids. These compounds are an essential feature in the life of adult Danaine butterflies (in India the genera *Danaus*, *Euploea*, *Parantica*, *Tirumala* and perhaps *Idea*), since the pheromones necessary for successful courtship will not be developed in their absence. In more purple prose male Danaines cannot activate their love dust before ingesting pyrrolizidine

alkaloids from a suitable source. However, the plant in question has not been biochemically assayed in this respect.

During intermittent butterfly studies in India, and especially New Delhi, between April 1984 and June 1985, I have observed large numbers of male Danaine butterflies coming to the blue flowers of *Ageratum conyzoides*, a weed associated with moisture. Although the flowers appear most suitable as an ordinary nectar source, Danaine specimens collected from the flower are almost invariably male. The only